

**WE CLAIM:**

1. A graphical user interface comprising:  
a rendered image of at least one graphical object  
wherein the graphical object using a number of pixels on  
5 a display device;  
a color value stored for each pixel in the display  
device; and  
object identification data stored with each pixel  
covered by the rendered image wherein the object  
10 identification data uniquely identifies the graphical  
object located at the pixel.

2. The graphical user interface of claim 1 wherein  
the rendered image comprises a three-dimensional image  
comprising at least two graphical objects that are co-  
located at at least one point in an x-y view plane,  
5 wherein only one of the co-located graphical objects is  
visible at a pixel corresponding to the at least one  
point and the object identification data for the pixel  
identifies the visible graphical object.

3. The graphical user interface of claim 1 further  
comprising processes for writing the object  
identification data with the color value to a frame  
buffer when drawing the rendered image of the at least  
5 one graphical object on the display device.

4. The graphical user interface of claim 1 further  
comprising processes for reading the object  
identification data with the color value from the frame  
buffer.

5. The graphical user interface of claim 1 further  
comprising a cursor pointing to a particular coordinate  
of the graphical display device, movement of which is  
controlled by user input.

6. The graphical user interface of claim 5 further comprising processes for reading the object identification data with the color value from the frame buffer of a pixel associated with the particular coordinate pointed to by the cursor.

7. The graphical user interface of claim 6 further comprising an interface for exporting the object identification information to an external process.

8. The graphical user interface of claim 6 further comprising a metadata information display object displayed on the display in response to the object identification data of the pixel associated with the particular coordinate pointed to by the cursor.

9. The graphical user interface of claim 6 further comprising an object-identification value indexed data structure holding metadata about the an object uniquely identified by the object identification value.

10. The graphical user interface of claim 6 further comprising a metadata information display object displayed on the display in response to the object identification data of the pixel associated with the particular coordinate pointed to by the cursor.

11. A method for providing information to a program using a graphical user interface, the method comprising:

rendering an image of a plurality of graphical objects at specified locations of a two-dimensional display device;

storing a color value for each location in the two-dimensional display device; and

storing object identification data for each of the specified locations, wherein the object identification

10 data uniquely identifies one of the graphical objects at the at least one location.

12. The method of claim 11 wherein from a particular viewpoint, at least two of the graphical objects intersect at at least one intersection location of image, and the object identification data stored at  
5 the pixel associated with the intersection location identifies an object that is visually closest to the viewpoint.

13. The method of claim 11 further comprising:  
using the object identification data to identify one of the intersecting graphical objects.

14. The method of claim 11 further comprising writing the object identification data with the color value to a frame buffer when drawing the rendered image of the plurality of graphical objects on the two-  
5 dimensional display device.

15. The method of claim 11 further comprising reading the object identification data with the color value from the frame buffer.

16. The method of claim 11 further comprising:  
receiving user input indicating movement on the two-dimensional display device; and  
pointing to a particular location of the two-  
5 dimensional graphical display device indicated by the user input.

17. The method of claim 16 further comprising reading, from the frame buffer, the object identification data with the color value of a pixel associated with the particular location pointed to.

18. The method of claim 17 further comprising exporting the object identification information to an external process.

19. The method of claim 17 further comprising displaying a metadata information display object on the two-dimensional display device in response to the object identification data read from the particular location  
5 pointed to.

20. The method of claim 17 further comprising storing metadata about the graphical objects in an object-identification value indexed data structure; and  
using the object-identification value read from the  
5 particular location pointed at to index into the data structure so as to retrieve metadata about a particular object.

21. The method of claim 20 further comprising displaying a metadata information display object displayed on the display in response to the object identification data.

22. A computer-readable medium containing instructions for controlling a data processing system to perform a method of providing information to a program object, the method comprising:

5 rendering an image of a graphical object at specified locations of a two-dimensional display device;  
storing a color value for each location in the two-dimensional display device; and  
storing object identification data for each of the  
10 specified locations, wherein the object identification data uniquely identifies one of the graphical objects at the at least one location; and

using the object identification data to identify the graphical objects.

23. The computer-readable medium of claim 22 wherein at least two of the graphical objects intersect at least one location on the two-dimensional display device

24. A method for associating graphical elements in a graphical user interface with metadata describing the graphical elements, the method comprising:

- 5 associating a unique object identification value with each graphical element;
- providing a data structure having an entry for each graphical element, each entry being associated with a particular object identification value; and
- 10 storing metadata about an associated graphical element in a corresponding entry of the data structure.

25 The method of claim 24 further comprising storing the unique object identification value in a frame buffer.

26. The method of claim 24 further comprising:

- determining display information describing how each graphical element is to be displayed;
- 5 storing the unique object identification value corresponding to the graphical element in a frame buffer location associated with the particular display location.

27. The method of claim 26 further comprising:

- receiving user-input identifying a user-identified location in the display; and
- 5 extracting the object identification value associated with the user-identified location from the frame buffer.

28. The method of claim 27 further comprising retrieving the stored metadata using the extracted object identification value.

29. A computer program product embodied in a tangible medium comprising computer program devices configured to cause a computer to associate graphical elements in a graphical user interface with metadata describing the graphical elements, the computer program product comprising:

first program devices configured to cause the computer to associate a unique object identification value with each graphical element;

second program devices configured to cause the computer to implement a data structure having an entry associated with a particular object identification value; and

third program devices configured to cause the computer to store metadata about an associated graphical element in a corresponding entry of the data structure.

30. The computer program product of claim 29 further comprising:

fourth program devices configured to cause the computer to determine display information describing how each graphical element is to be displayed;

fifth program devices configured to cause the computer to select one graphical elements as a front-most graphical element at each pixel; and

sixth program devices configured to cause the computer to store the unique object identification value corresponding to the front-most graphical element in a frame buffer location associated with the particular display location at which the front-most graphical element is displayed.

31. The method of claim 30 further comprising:

seventh program devices configured to cause the computer to receive user-input identifying a user-identified location in the display; and

5 eighth program devices configured to cause the computer to extract the object identification value associated with the user-identified location from the frame buffer.

32. The method of claim 30 further comprising ninth program devices configured to cause the computer to retrieve the stored metadata using the extracted object identification value.

33. A system for displaying and interacting with graphic objects, the system comprising:

a display device comprising a plurality of pixels arranged in a two-dimensional array, wherein graphical objects may be associated with any of the plurality of pixels;

a frame buffer having a plurality of entries where each entry is associated with one of the plurality of pixels; and

10 object identification information corresponding to one of the graphical objects, the object identification information being stored in the frame buffer.

34. A computerized system comprising:

a display comprising a plurality of pixels where each pixel is located at a defined coordinate;

5 an application process generating a plurality of graphical objects, each graphical object having a unique object identification (ID) value;

a rendering process receiving the plurality of graphical objects and determining visible surfaces of the

10 plurality of graphical objects with respect to a predetermined perspective;

a pixel map comprising a plurality of entries, each entry corresponding to one of the visible surfaces determined by the rendering process;

15 object identification data associated with at least some of the entries in the pixel map;

a pointer movable to selected coordinates of the display, movement of which is controlled by a pointing device; and

20 an object identification process coupled to read the coordinates of a selected pixel pointed to by the pointer and extract the object identification information associated with the pixel.

35. A user interface for a three-dimensional environment comprising:

a pointer, movement of which is controlled by a pointing device;

5 at least one graphical object displayed on at least one pixel of a display;

a frame buffer having memory for the at least one pixel, the memory including a first field for holding display information and a second field for holding object identification information.

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36. A frame buffer comprising:

a plurality of memory locations, each memory being associated with a pixel of a display device;

5 display data stored the memory locations, the display data indicating how the pixel is to be activated; and

object identification data stored in at least some of the memory locations, the object identification data



indicating a unique software graphical object being  
10 displayed by the pixel.